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Investigation and Design of Mobile OPAC Services (MOS) for Non-Smartphone Users

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Abstract: This research focuses on providing Online Public Access Catalog services to university students via mobile phone in order to enhance the traditional library walk in services and online library access using a computer. This research comprises of three main findings in relation with mobile OPAC services. First, it investigates student's perception in using mobile phone to access OPAC services in the educational environment. Next, it identifies and adopts mobile content design guidelines in the development of Mobile OPAC Services (MOS) prototype application. Third, it develops MOS prototype Application for Non-Smartphone users. Quantitative and qualitative data analysis techniques conducted to identify student's uses and needs for mobile library services access. The survey derived 73% of the students prefer to access the Online Public Access Catalog (OPAC) via mobile phone. The reason being is that OPAC provide major services of the library such as searching for learning materials, new titles in the library, reservation list and other related services. By conducting the survey, we discovered 71% of the students are using non-smart phone because they are still studying and unable to buy a smart phone which is expensive. Based on this finding we design a Mobile OPAC Service (MOS) prototype application for university students to access Online Public Access Catalog services via non-smart phones. The mobile OPAC services will bring libraries one step ahead in the wireless information technology world in meeting their patrons needs and providing quality education resources.

Keywords: *Mobile OPAC Services (MOS), non-smartphone, user's perception, usability guidelines, user centric*

1. Introduction

The strong point associated with a mobile phone is always being handy while not being dependent on its location and being able to access into wealth of information or services. The emergence of 3G/4G wireless technology and services over mobile phones are becoming added advantage to access various internet services liable within the competence of mobile device and technology. Mobile web based services such as accessing emails, searching, mapping, messaging, social networking and information query are becoming available greatly in mobile environment. The importance of mobile phones in this research goes way in the educational environment from the context of accessing OPAC services. Nowadays, very less people go to the library, reason being occupied with work, inconvenient to carry books or increased traffic jam to reach library. Therefore, the traditional library services facing difficulty in meeting library user's expectation. The rapid development of mobile devices provides a good platform for the expansion of library services for the reader (Yue, 2010). Mobile phone became an essential tool for users to communicate and collaborate in the educational environment. Mobile phone can be utilized effectively in providing OPAC services to library users. This research paper is arranged as follows: Section 2 presents the literature review mobile phone usage in academic environment, the importance of mobile library services, existing mobile phone application in library, comparison between smartphone and non-smartphone and guidelines to improve mobile content design. Section 3 discusses research methods and data capture analysis. Section 4 explains the system design and system architecture. Section 5 highlights screen design with the adopted usability guidelines. Section 6 describes the implementation of MOS prototype application, software tools, user evaluation and results. Section 7 concludes by explaining the findings of this research.

2. Literature Review

Mobile Phone in Academic Environment: As the wireless technology grows tremendously, there is a need to facilitate students with enhanced technologies to gain knowledge and skills. Online teaching, online training and World Wide Web are available for students to learn and retrieve information by using mobile devices,

personal digital assistants (PDA), or laptops. The continuous development and improvement of the Internet, Mobile Education Network and Mobile Telecommunications Equipment and the gradual increase in the level of the rural economy and the concept of modern learning, lifelong learning, in-depth impact and teacher's requirement for further educational technology, mobile learning becomes tool for teachers to develop and improve their educational technology Jungi et al. (2010). As indicated by Karim et al. (2006) at the moment most of patrons learning in the academic institution having a cellular phone and it is expected that mobile services will be the best access point in catering reliable information access to the educational institutions.

The Importance of Mobile Library Services: Information technology is playing a vital role in academic library because rapid advances in information communication technology are moving the library to online teaching era. The rapid growth in information systems makes libraries have found it challenging to retain with increased demands using traditional operations and the concept of a library has had to transform into automated library services. This is due to the library information user is no longer restricted to the walls of the library. The widely held of academic libraries are now hybrid libraries which mean the library system is dependent on both electronic and print media based via networks with physical facilities. According to (Yue, 2010), the mobile libraries will realize the dynamic release of mobile information, mobile information queries, mobile renewals and reservations, mobile virtual reference service, electronic resources uploading and downloading and search permissions to access electronic literature database. In recent years, the rapid development of mobile devices provides a good platform for the expansion of library services for the reader explained by (Yue, 2010). Having a mobile phone or any handled device become an important tool for communication and exchanging information. Thus, providing library services via mobile phones expand the scope of library services to offer information access anywhere and anytime to patrons. As mobile phones is playing an important role in the library there are few research papers reviewed. After reviewing the related work of mobile library services access, it has clearly denoted that the research uses smart phones for accessing the library services rather than non-smartphone. This is due to smart phone possess a wider screen, runs on operating system which function almost the same as laptop.

Existing Mobile Phone Applications in Library: We investigate many existing mobile phone usage in library and academic sectors. The existing system is more into sending notification to patrons in terms of library item due date and library fine. Many institutes are proposing a framework for mobile application for library services perhaps still under development environment. The development of information technology and mobile phones become an obligatory tool in human's day to day life. This is remarkable that people who visited libraries to find specific information in the past are now able to find that information online. As the spectrum of human need grows, the opportunities for librarians to meet these needs are also growing. The mobile library services will fulfill the library patrons need in getting information. According to (Huang, 2011), it is reported that services provided by college and university libraries through mobile phones are mainly SMS, WAP services and mobile-friendly websites are not easy to find. Mobile phone library services basically use SMS of the mobile phone technology and mainly provide some services with simple functions such as returning and renewing books by SMS (Fang, 2011). Huang (2011) Surveyed the library patron's favorite mobile services that they would prefer to access via mobile phone are listed below:

- Searching the library catalogue and reserving items.
- Checking one's loan status and renewing loan items.
- Viewing upcoming library events and new book arrivals.
- Sending queries to our librarians.
- Reading our library blogs.
- Subscribing to free e-notification/reminder service.
- Downloading electronic books, video games and audio stories.
- Send an ISBN to check whether a book is in the library.
- Book purchase suggestions.
- Searching articles.
- A location-aware mobile library service helps readers to find books and other materials from the library quickly

Majority of the library patrons with non-smart phone don't read journal articles or eBooks, as the screen quality is poor. By then, the smart phone users already more inclined to read eBooks on their phones or

reserved reading books. This shows the smart phone users able to use more library services compare to non-smartphone users. (Huang, 2011) Recommend that it would be more cost effective to either provide the same library application through website, or to develop application in Java, which will run on most other phones. In the context of academic sector most of the library has implemented web based OPAC to their patron and some have begun to deploy specialized mobile access application as well Zhou et al. (2010). The advancement of information technology is a tool for library to stay well-informed and to cater their patrons with quick information access. According to Karim et al. (2006) suggested that libraries should highlight development of mobile options. They developed a set of user experiments comparing three interface styles and a commercial service on a mobile device which the result shows that different approaches can help users to explore Web search results more efficiently.

A survey conducted by Zhou et al. (2010) at University of Texas to investigate students, staff and faculty regarding their uses and needs for mobile catalog access indicated majority users prefer mobile catalogue access for searching library information and noted that simplicity is important when using mobile options. In the survey the respondents considered advanced search and search type for library materials to be the most important features for mobile catalog access. The author also developed a prototype mobile application for accessing their University OPAC based on Android Software Development Kit (SDK), Eclipse Emulator and Integrated Development Environment (IDE) which is compatible to Android SDK. The prototype application includes a menu with Search, Scan ISBN, about and Book List. The findings of this literature point out that task specificity or simplicity of an interface is important rather than having too text-heavy. Apart from this, the fit of custom mobile applications on the screen critically reduces time and frustration for users.

Comparison between Non-Smartphone and Smartphone: The comparison between smartphone and non-smartphone can be due to differences between these two devices in terms of content display, internet access, operating system, wireless communication, touch screen, document editing and memory card. The screen display for smartphone consist larger screen compare to non-smartphone which comes with limited screen size. The non-smartphone is designed to enable user to browse internet like how they browse with their computer and more user interaction with the online resources. By then, the non-smartphone cater users browse internet for basic activity. Most of the non-smartphone support Wireless Application Protocol (WAP) to access internet and smartphone can support WIFI, 3G, 4G and other sophisticated wireless communication. The smartphone has a touch sensitive display which respond finger, stylus or both. Most of the smartphone has the capability of touch screen to input data, launch phone features, zoom webpages or virtual control. The non-smartphone do not support touch screen features since the screen display is limited. The non-smartphone able to view document or support some organizer features. The non-smartphone goes one step higher by not only viewing the document but able to edit, delete or create document. Since smartphone comes with mobile operating system which include many software application such as WordPad, slides or even edit document in their email inbox. Many smartphones have spaces that include memory cards storage to magnify their storage size. This also includes removable cards serve easy way to shift files between two devices. Smartphone generally need more memory space since much application can be installed, to view graphics and picture and to download software from internet.

Guidelines to Improve Mobile Content Design: A research by (Seong, 2006) stated following the right usability guidelines which is denoted by following the correct direction and principle to access particular object or action will represent the best practices in a given context domain. The limitations of mobile phone such as screen size, processing power, memory and other limitation are studied. A task oriented information display on mobile phone will minimize screen size limitation whereby the required information is well displayed on mobile phone. The literature review identified some important guidelines on minimizing mobile phone limitation in terms of mobile content design. The researcher will be using these guidelines during screen designing phase. The guidelines for mobile content design are identified as below.

- **Minimize Human Cognitive Load** – The mobile OPAC access needs to be in small consistent information. Smaller screen will slow down the reading speed by disrupting the eye movement's normal pattern. Hence, it is advisable to avoid unnecessary information and only display required information to the user. By this, it can minimize learner's cognitive load.

- **Consistency** – Consistency is the most basic characteristic in usability interface design principles. Similar information and action need to be inserted in the similar position. The library patrons who use web based OPAC services able to understand and utilize the mobile based OPAC services in terms of the system functionality.

- **Navigation** – Difficulties to navigate through the mobile devices causes users to get disoriented in a menu system, without knowing where there are, where to go next and how to get back to previous navigation routes or known parts in the menu. This especially for menus implemented in small screen sizes and constrained navigational ability. Navigation should always be consistent in all prepared pages. Consistent navigation will maintain learner's pace and retaining learning interest and it can also minimize the number of scrolling frequently.

3. Methodology

We adopted both survey questionnaire and interview techniques as the research instruments for data gathering. The questionnaire data were collected from undergraduates and postgraduates students from a private university with different academic specialism. A sample of 100 students was selected for the study. We used this survey to gather information, requirement, opinions, perception and familiarity of the target users on accessing OPAC via mobile phone. We used self-administered paper-based questionnaire method to gather information from the respondents. Besides that, two librarians from the same private university are interviewed to give opinions on the existing library services and accessing OPAC via mobile phone. The questionnaire was designed in four sections. Utilization of Library Services and OPAC, Mobile Phone Usage and Perception on accessing OPAC services via mobile phone. Based on this finding, we will choose the most preferred type of OPAC services or user centric services to be implemented under the mobile OPAC prototype implementation.

4. Data Analysis and Requirement Capture

The result and analysis of the data will contribute to the finding of student's perception in adopting mobile device to access OPAC thru questionnaire. Analysis of collected data is an imperative pathway to final solutions of the problem statement.

Utilization of Library Services and Online Public Access Catalogue (OPAC): The details on utilization of library services and Online Public Access Catalog (OPAC) were acquired based on the frequency of students visiting their university library website and the services they use also taken into consideration. Beside this, students were also enquired on the use of Online Public Access Catalog services and the type of search the use most in searching for books, journals, conference papers, CD-ROM or other related materials. The result from the survey shows high percentage of the respondent visit the library website everyday which comprises (55%), around (25%) of the students visit 2 to 3 times in a week, and followed by (20%) of students visit once in a week. Generally, all the students visit the university library website for some purpose for their studies. Information on types of online library services acquired by students is presented in Table 1. The types of services provided by university library are online databases, OPAC, Online Book Stores, Newspaper clipping and search for other library resources. The result is displayed in terms of the higher percentage distribution for most acquired services by the students. The result shows that (73%) of students prefer to access the Online Public Access Catalog (OPAC). This can be due to the OPAC provide various services which require the students to access the information on daily basis in searching books, renewing books, paying fines, checking new titles and other related services. Besides that, the (10%) of the students prefer to search information from other library resources. This can be due to the respondent consist of undergraduate and postgraduate students where they need to find extra resources for their project or dissertation from the twinning program with the respective University Library.

Table 1: Percentage of Students Accessing University Library Website

Preference in Accessing OPAC Via Mobile Phone	No. of Students in Percentage
Yes	91%
No	9%

Mobile Phone Usage among Students: In this section, student's nature of using mobile phone services was discovered. The findings show that all the students are using mobile phone regardless undergraduate or postgraduate students. By conducting the survey, we notice that most of the students are using non-smart phone which comprises 71%. This can be due to respondents are students and most of them dependent to their parents for their expenses. Furthermore, smartphone is very expensive compare to non-smart phones. This finding elicits (39%) of undergraduate students using non-smart phone and (32%) of postgraduate also using non-smart phone. The rest of the students are using smartphone such as iPhone, Blackberry, Samsung HTC and other model smartphone which comprises the combination of PDA and cellular phone capability.

The survey also draws that around 92% of students are using prepaid and only 8% using the postpaid plan. By this also, the researcher discovered the maximum of students spending for one month is RM50-RM100 which was (73%) and the least spending amount goes to RM10-50 which was (5%). Apart from this, students prefer to use short messaging services which was (45%), browsing internet (37%), games (13%) and multimedia messaging services (5%). Students prefer to use short messaging services (SMS) because it's cheaper and immediately their message will be conveyed to receiver. By then, browsing internet via mobile phone is also famous among respondents where they could check class timetable, lecture notes, library website, university web portal and other related website in terms of their education.

Table 2: Student's Preference in Accessing OPAC Services via Mobile Phone

Online Library Services	Response Sampling	Percentage
Online Public Access Catalogue (OPAC)	100	73%
Search for Other library resource from Staffordshire University Library	100	10%
Online Databases	100	8%
Online Book Stores (Amazon, Alibris, Kinokuniya, MPH Online, AbeBooks and Barnes & Noble)	100	6%
Referencing Guides (Harvard Referencing, Library Links and Find Facts, Useful Links)	100	3%

Students Perception on Accessing OPAC via Mobile Phone: In this section, the survey provides findings on the student's opinion on accessing OPAC via mobile phone. First the students were asked on mobile access to OPAC a service is retrieving information at anytime and anywhere. This is because mobile phone is handy and students can be at anywhere not necessary have to be at library physically. As long as the internet connection is available students may access library website easily. Next, student's points of view are also surveyed if this will prefer to retrieve OPAC information via mobile device. This is an important question for this research because the researcher can able to identify the student's interest which cater realization for this research. The student's attitude for preferring mobile phone in accessing OPAC was found to be very positive. Totally, (91%) of students shows their positive perception in using mobile phone to access OPAC which is shown in the following Table 2. Apart from this, various OPAC services offered in the university online library website were listed in the survey and the students are required to select the type of services they like to access. This type of services was measured in a likert scale of 1 out of 5 scales whereby the higher end indicates support. The likert scale denotes 1 (Never), 2 (Rarely), 3(Sometimes), 2(Often) and 5(Very Often). Based on this finding, the researcher can determine what type of OPAC services famous or students would like to access most via their mobile phone.

The result of this finding is displayed in Table 3. The result is shown in terms of mean's value and standard deviations. If the mean is nearer to the value 5 which denotes student's interest in browsing the type services is consider higher. The findings from this section reveal students interest in browsing particular OPAC services. Table 3 shows the highest mean value denotes student's highest interest in accessing this type of OPAC services via mobile phones. The result from Table 3 reveals that OPAC search is the most famous type of OPAC service student's like to access which has the highest mean value of (4.49). The reason could be OPAC search gives the opportunity to students to browse on reference books, articles, journals and other learning materials for their exam preparation or research. Next, the result shows that, browsing for New Titles shows

the mean value of (4.31) which indicates students second highest preference under OPAC service, viewing for library loan has mean value of (4.17), to view reservation list made by students has the mean value of (4.14), reservation of books for students who prefer to do early booking with mean value of (3.94), and lastly library fine services has the lowest mean value of (3.82).

Table 3: Preference on type of OPAC services

Type of Services In OPAC	Mean Value	Mode	Standard Deviation
OPAC Search	4.49	4	1.05
New Titles	4.31	4	1.04
Library Loan	4.17	4	0.97
Reservation List	4.14	4	1.08
Reservation of Books	3.94	3	2.06
Library Fine	3.82	3	1.18

Scale: 1(Never), 2(Rarely), 3(Sometimes), 4(Often), 5(Very Often)

This services which has mean value above four will be used as user's preference services when implementing the MOS prototype application.

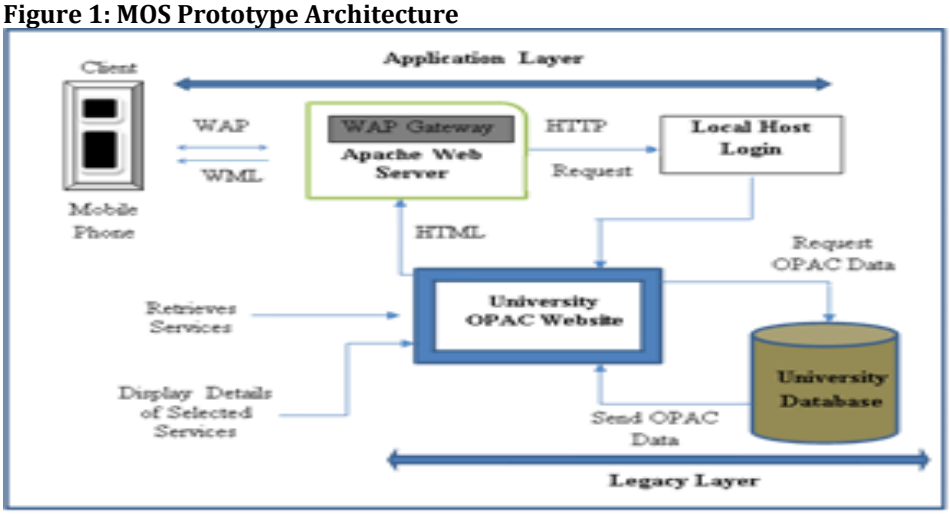
Finding from the Interview with Librarian: The interview was meant to acquire information about existing library services, library management system and the perception on accessing Online Public Access Catalog via mobile phone. The librarian defined the Library Management System as a system to manage people, resources (information) and the ability to provide information needed. The Library Management System runs on repository database, where library membership records and transaction details are stored which is accessible by other departments such as the international office, technical department and admin department. Furthermore, the librarians pointed out about certain problems being encountered in the library, such as the enquiries that patrons normally make during the peak period which invariably takes much time and resulted to other patrons standing on the queue for longer period. As a result of this, more staff have to be on standby during the peak period, which typically and resumption day after holiday or after weekends. Mainly on Monday morning, some hours after lunch and after morning classes. The librarian also shared of increasing number of personnel from two to four workers on duty, which is quite at expenses of the library. She talked about currently available channels to enjoy the services provided are the online and the walk in services. The important factor which bring realization to the research was discovered when both the interviewee are supporting in terms offering Online Public Access Catalog via mobile phone which can minimize the problem from the conventional walk in service and added advantage for the current online library system.

User Requirement Analysis for MOS Prototype Development: Gathering user requirement for research proposal is important element in determining system requirement. The system requirement analysis will lead into system design phase, implementation and testing phase at the appropriate level. The questionnaire technique used in the research methods is used to capture student's perceptions in terms of accessing Online Public Access Catalog (OPAC) via mobile phone. The student's perception will be analyzed as user requirement in developing the Mobile OPAC Service (MOS) prototype. The most preferred OPAC services which have the average mean value of four during the questionnaire analysis will be used as an important user requirement for this research. This is due to provide user centric services on the development of MOS prototype application. User centric services can be better designed to fulfill the user's needs. The analysis on the type of mobile device using by the students stated that most of the students are using non-smartphone with the survey analysis of 71%. Hence, the development of Mobile OPAC Access shall concentrate on non-smartphone which is affordable by students since the price is cheaper compare to smartphone.

System Design

System Architecture: The system architecture for this research explains the conceptual overview of the MOS prototype in terms of the structure, behavior and communication which will toil together to build up the overall system. The system architecture reveals the fundamental design process of the system. Since this research involved in developing OPAC application on non-smart phone, the WAP protocol is adopted for the prototype implementation. The system will be represented by showing the functionality between the hardware and software components along with the human interaction with these components at three layer architecture structure. The system architecture design is presented in figure 1. The MOS prototype development shows three layer architecture consist of layer 1- Client, layer 2- Application Layer and layer 3- Legacy Layer.

Figure 1: MOS Prototype Architecture



Layer 1-Client: This layer is the user interface layer of MOS prototype system. It consists of all the components that responsible in receiving the input from the mobile user and display the output received from the application layer to the user. The client requesting for an OPAC services will submit a query via WAP to the WAP gateway. The WAP gateway will transmit the output from the application layer to the client. The WAP gateway is in control of connecting client layer and the application layer together.

Layer 2 – Application Layer: The application layer act as a middle layer between client layer and legacy layer. The web server used for MOS prototype application is the Apache server. Apache server is a widely used open source web server. Apache server is powerful and flexible is accommodating various different configurations. The Apache web server is responsible in hosting up the WAP gateway. The web scripting language used for MOS prototype application is PHP. The Application Layer communication is as follows:

- The WAP gateway at the application layer will receive a WAP request from the client.
- The WAP gateway will transforms the WAP request into an HTTP request which is the Login Host.
- The HTTP request will be directed to the legacy layer to obtain the output. After that, the output which is in HTML page format is transmitted to the WAP gateway.
- The WAP gateway will convert the output which is in HTML page format into WML page content to the mobile phone client.

Layer 3 – Legacy Layer: The legacy layer consists of the existing University OPAC website and University database. The University OPAC website will be converted into WML page content by WAP gateway at the application layer. Later, the OPAC page content in WML format will be displayed to client's mobile phone. In the development of MOS prototype application, the University database was utilized to retrieve and update OPAC data. The interface of the database is not visible in the development of the MOS prototype application.

Screen Design: The screen design explains the design of MOS prototype application before the implementation phase. In any research study the screen design is very important because the screen act as the communication channel between the system functionality and the users. The screen design for MOS prototype application is designed based on the guidelines which were adopted from the literature review and further explanation on the adoption of the guidelines in explained below.

Adoption of Minimize Human Cognitive Load into Screen Design: User involvement in terms of specifying context of use, specify requirement and evaluation will determine user centric services. This is important with centric services development as users have their own expectation and what is required for them to ensure that the system is a success. The OPAC Search and Reservation List screen design in the following pages are the most preferred services selected by user which has mean value more than four. For example, in the OPAC Search screen the user can search for any library information by the search criteria. The result of the first search hits is displayed in one mobile page or card and the following search hits in the next card. The user can click the next option from the Menu button to view the next search result. The search information is not overloaded in one mobile page as there are many search hits. Overall, the screen design information display is broken into chunks to display information fit well within the small screen.

Adoption of Consistency into Screen Design: The consistency reflects the appropriate content presentation and result. The format, structure and actions designed to be parallel for all the screen designs and able to produce accurate output. Mobile users and web based user transact the similar information. Consistent in design process is important in providing users with the real usage context and useful.

Adoption of Navigation into Screen Design: The navigational menu shows simplicity. The screen design are easy to navigate and simple, this means the operation is understandable, reduced user's searching time and improved level of satisfaction. The designing of the screen with ample white space provides ease of use as such it improve user's performance, improved efficiency and low latency.

System Implementation

Software Development Tools: The software development tools adopted for this prototype implementation are XAMPP, Operating System, Web scripting Language, Web Server Markup Language, Web Access and Control Library Mobile Emulator and Wireless Protocol. The functional user interface for the MOS application was implemented based on user requirement collected during analysis phase. User centric services are given importance in designing the user interface. User centric service is referring to important functional requirement were developed to meet user requirement. Text based interface design adopted for this research because it will help the users to query for their required information in easy manner without wasting time. Figure 2 below shows the MOS prototype application's OPAC search screen followed by Figure 3 which describe the OPAC search result. The OPAC search result screen outline details on title code, call no, ISBN, author, type publisher and category.

User Evaluation: The prototype was evaluated under the main criteria of justifying the mobile content design guidelines for developing the MOS prototype application. This evaluation process is to understand the user collaboration towards using non smartphone to access library resources. The following sections highlight the detailed analysis and finding of the evaluation results.

Details of Respondents: The user evaluation for MOS prototype application were participated by 20 students of the same private university. Out of these 20 students, 10 students were from undergraduate studies and the remaining 10 students belong to postgraduate studies. All this 20 students are using non smartphone and WAP to access internet.

Figure 2: OPAC Search Screen

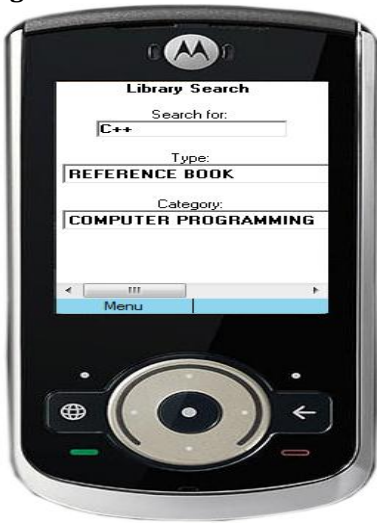
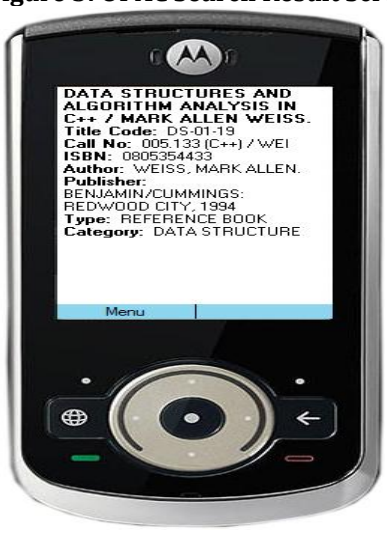


Figure 3: OPAC Search Result Screen



Data Collection Method: This study has adopted a questionnaire technique to obtain response from users. 20 questionnaires distributed to students to evaluate MOS prototype application in terms of justifying mobile content design guidelines along with user centric services. The questionnaire consisted of three questions in one section. The section consists of likert-Scale type questions acquiring user satisfaction rating of Strongly Agree, Agree, Neutral, Disagree, and Totally Disagree.

Justifying Mobile Content Design Guidelines: The mobile content design guidelines which are adopted from the literature review in designing the mobile content design for the MOS prototype application will be used to justify whether the quality of designing mobile content is fulfilling the user requirement. The three guidelines used to design the MOS prototype screens are minimize human cognitive load, consistency and navigation. The three guidelines were transformed to three mobile content display design questions in Section A of the questionnaire. Following are the explanation on the mobile content design guidelines which will be used for this evaluation.

User Evaluation Results: The evaluation questionnaire consists of three questions explained the results of user response in terms of three mobile content design guidelines. The detailed discussion of the result is further explained in the following sections.

User Evaluation to Minimize Human Cognitive Load

- **Beneficial Criteria:** The evaluated minimize human cognitive load based on beneficial criteria result shows were good. Majority of the respondent stated that the MOS prototype application is beneficial for them while only small number of percentage were uncertain about the benefits. This is due to the respondents still preferred in accessing OPAC via computer. Around, 60% of the respondents strongly agreed that MOS prototype application is beneficial. Another 30% of respondents agreed while 10 % were uncertain about the MOS prototype application.
- **Consistency:** 50% students strongly agreed and 35 % agreed the prototype application is consistent. Apart from this, 15% of respondents were uncertain about the consistency of the MOS prototype application. This consistency evaluation shows majority of the respondents specified that the library data they view in the MOS prototype application is consistent with the OPAC web based system.
- **Navigation:** The ease of navigating the prototype application indicated a positive sign from the respondents. 45% of the respondents agreed the MOS prototype application is easy to learn and navigate. Another 25% strongly agreed while 15 % of the respondents were neutral about the learnability of MOS prototype application. There were only 10% disagreed and 5% strongly disagree about the learn ability of the prototype.

5. Conclusion

The survey questionnaire depicted a positive result from students in receiving mobile application as further enhancement towards traditional library method is accessing library resources and enable the researcher to identify students most preferred OPAC services. These user centric services are used in developing the functional requirement for MOS prototype application. Besides that, this survey analysis brings realization to this research as the MOS prototype application is based on non-smartphone. Most of the students are using non-smartphone due to they are still studying and unable to afford for a smartphone which is expensive. A detail study on literature review the researcher discovered some useful guidelines such as minimize human cognitive load, consistency and navigation. These guidelines are used in designing the MOS prototype screen design. The reason for adopting these guidelines is to minimize the limitation of non-smartphone in displaying content on limited screen size. These three guidelines are further justified in the user evaluation process whether the chosen guidelines are appropriate for designing the mobile content design. The implementation of the prototype application is associated with user's responses, literature studies and non-smartphone features. The evaluation process result indicated a positive response from the users and majority of the users are satisfied with the consistence, navigation and user centric services offered in the MOS prototype application.

Research Limitation: The MOS prototype application is developed to cater mobility in accessing OPAC services. On the other hand, the current OPAC services could be accessed by laptop or computer will provide the whole view compare to non-smartphone. The prototype application has limitation in terms of displaying all the library features apart from OPAC services.

Future Enhancement: The research has highlighted the various approaches in implementing the MOS prototype application. The researcher will propose future enhancement in catering the overall library services information together with OPAC services. Apart from this, other issues like the acceptance or rationality of MOS prototype application together with the system limitation that might evolve must be well examined. Looking ahead, the improvement of this prototype application can be made by offering services such as enabling users to download electronic library items, allowing uses to receive SMS notification from library system on due items and a map function to direct users to locate books in the library.

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